

Engineering Design File

PROJECT FILE NO. 020996

Staging, Storage, Sizing and Treatment Facility

Sanitary Sewer Lift Station

Prepared for:
U.S. Department of Energy
Idaho Operations Office
Idaho Falls, Idaho



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ENGINEERING DESIGN FILE

PROJECT FILE NO.

020996

EDF DOCUMENT NO.

EDF-1937

REVISION NO.

0

PROJECT/TASK SSSTF

SUBTASK SANITARY SEWER LIST STATION PUMP DESIGN

EDF PAGE NO. 1 OF 11

TITLE

SSSTF Sanitary Sewer Pump Design

SITE AREA

INTEC

BUILDING NO.

SSC IDENTIFICATION/EQUIPMENT NO.

SUMMARY

This Engineering Design File (EDF) contains the calculations for the sanitary sewer lift station pump design for the Staging, Storage, Sizing and Treatment Facility (SSSTF) Administration and Decon Building. The Administration building has two restrooms, each with a toilet and sink, a janitor closet with mop basin, and a utility sink. The Decon facility has two restrooms with showers, a drinking fountain and a utility sink. The total length of the pipe run is 1700 ft. with two long sweep 90-degree turns. The pipe will be a 2-inch HDPE pipe.

Conclusions:

The expected pump design flow rate for the Administration and Decon facilities is 24 gpm. A 2-inch HDPE pipe will experience a total pressure loss of 14 psi for a 1700 ft. run and a 1.5 safety factor (includes the two 90-degree long sweeps). The cycle time for the pumps at 24 gpm is 14 minutes and about 4 times per hour or 2 times per hour per pump. The operating of the pumps will be setup to run alternately to keep the pumps exercised and to provide redundancy in the pumping system. The total flow for the Administration and Decon facilities combined is 1400 gpd.

REFERENCES:

1. Uniform Plumbing Code (UPC)
2. Crane, Flow of Fluids Through Valves, Fittings, and Pipe
3. IDAPA
4. Recommended Standards for Wastewater Facilities - 1997

NPH PERFORMANCE CATEGORY (DOE-STD 1021) PC-0 PC-1 PC-2 PC-3 PC-4 Not Applicable

SAFETY CATEGORY (MCP-540) Safety Class Safety Significant Low Safety Consequence Consumer Grade Not Applicable

KEYWORDS (e.g. area, structure no., general subject matter, etc.): **SSSTF, Sanitary Sewer, Lift Station, Pump Design**

AUTHOR

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3/1/02

INDEPENDENT PEER REVIEWER

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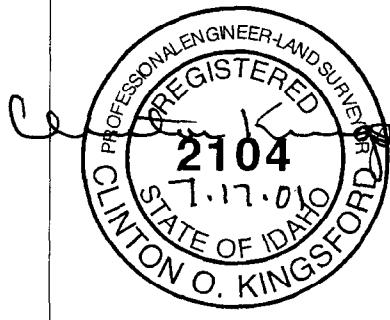
3/8/02

BBWI REQUESTOR

R. L. Davison

DATE

3/7/02



SSSTF SANITARY SEWER PUMP DESIGN	Drainage Fixture Unit (DFU)*		Total DFU	* From the Uniform Plumbing Code (UPC) (See table 6.4 from the UPC)
	Total Amount			

ADMIN BUILDING

Toilet	2	1	2	
Urinal	0	4	0	
Sink	2	2	4	
Shower	0	2	0	
Drinking Fountain	0	0.5	0	
Janitor Closet	1	3	3	
Utility Sink	1	3	3	
			TOTAL DFU	12

DECON FACILITY

Toilet	4	1	4	
Urinal	1	4	4	
Sink	5	2	10	
Shower	5	2	10	
Drinking Fountain	1	0.5	0.5	
Janitor Closet	1	3	3	
Utility Sink	1	3	3	
			TOTAL DFU	34.5

TOTAL OF BOTH BUILDINGS 46.5

2 DFU = 1 gpm UPC pg. 65

Therefore 46.5 DFU = 24 gpm pump needed

Total length of pipe = 1700 ft

A 2-inch HDPE pipe will be used:

$$\begin{array}{l}
 0.561 \text{ psi}/100 \text{ ft} \quad \text{Crane Pg. B-14} \\
 \times \underline{1700 \text{ ft}} \\
 \hline
 9.54 \text{ psi} \\
 \times \underline{1.5 \text{ for Safety Factor (includes bends/elbows)}} \\
 \hline
 14 \text{ psi needed}
 \end{array}$$

FACILITY FLOW RATES

	Admin. Facility	Decon Facility
Number of employees (includes staff and field personnel)	25	25
Wastewater flow from various sources in gpd per employee, from IDAPA 16.01.03**	20	35
Total gpd per facility =	500	875
Total flow rate in gpd =	1400	

** The admin facility was considered an office and
the decon facility a factory with showers

31
11

Flow of Water Through Schedule 40 Steel Pipe

Pressure Drop per 100 feet and Velocity in Schedule 40 Pipe for Water at 60 F.											
Discharge		Velo-	Pres-	Velo-	Pres-	Velo-	Pres-	Velo-	Pres-	Velo-	Pres-
Seconds	Cubic Ft.	ity	Drop	Feet	Lbs.	ity	Drop	Feet	Lbs.	ity	Drop
per	per	per	Second	Sec. In.	per	per	Second	Sec. In.	per	per	Second
Minute	Second	Second	Second	Sec. In.	Second	Second	Second	Sec. In.	Second	Second	Second
				$\frac{1}{8}$ "		$\frac{1}{4}$ "		$\frac{3}{8}$ "		$\frac{1}{2}$ "	
1	0.000446	1.13	1.26	0.816	0.399	1	0.000446	0.317	0.361	$\frac{3}{4}$ "	
1	0.000446	1.13	1.26	0.914	0.903	0.304	0.398	0.317	0.361	$\frac{3}{4}$ "	
1	0.000491	2.16	6.98	1.23	1.61	0.572	0.348	0.422	0.368	$\frac{3}{4}$ "	
1	0.001111	2.82	10.5	1.54	1.38	0.440	0.339	0.378	0.387	0.301	0.0331
1	0.00134	3.16	14.7	1.83	1.29	1.01	0.731	0.837	0.341	0.340	0.341
1	0.00178	4.72	25.0	2.46	8.44	1.34	1.23	0.844	0.408	0.481	0.1021
1	0.00213	5.65	37.2	3.08	8.28	1.64	1.85	1.06	0.500	0.602	0.1881
2	0.00446	11.19	134.4	9.16	30.1	3.76	6.58	2.11	1.19	1.20	0.326
2	0.00446	11.19	134.4	9.23	34.1	7.04	13.9	3.17	4.23	1.81	0.326
2	0.00446	12.33	111.3	6.72	21.9	4.22	7.42	2.41	1.83	1.92	0.346
2	0.01114	2"		8.40	36.7	7.18	11.1	3.01	2.75	1.86	0.318
3	0.01114	2"		9.23	37.0	7.18	11.1	3.01	2.75	1.86	0.318
4	0.01114	2"		10.08	81.9	6.33	15.8	3.61	3.84	2.23	1.17
4	0.01114	2"		11.44	91.1	8.45	27.7	4.81	6.02	0.99	0.471
4	0.01114	2"		10.76	42.4	10.76	42.4	6.02	6.99	3.71	2.11
5	0.01114	2"		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
6	0.01114	2 $\frac{1}{2}$ "		10.08	81.9	6.33	15.8	3.61	3.84	2.23	1.17
6	0.01114	2 $\frac{1}{2}$ "		11.44	91.1	8.45	27.7	4.81	6.02	0.99	0.471
6	0.01114	2 $\frac{1}{2}$ "		10.76	42.4	10.76	42.4	6.02	6.99	3.71	2.11
7	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
8	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
9	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
10	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
11	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
12	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
13	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
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15	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
16	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
17	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
18	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
19	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
20	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
21	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
22	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
23	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
24	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
25	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
26	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
27	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
28	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
29	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
30	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
31	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
32	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
33	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
34	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
35	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
36	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
37	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
38	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
39	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
40	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
41	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
42	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
43	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
44	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
45	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
46	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
47	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
48	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
49	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
50	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
51	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
52	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
53	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
54	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
55	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
56	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
57	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
58	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
59	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
60	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
61	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
62	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
63	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
64	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
65	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
66	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
67	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
68	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
69	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
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71	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
72	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
73	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
74	0.01114	2 $\frac{1}{2}$ "		12.03	111.3	3.01	3.01	3.01	3.01	2.22	1.37
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4/11

TABLE 7-3
Drainage Fixture Unit Values (DFU)

Individual Fixtures	Min. Size Trap and Trap Arm ⁷	Private		Public	
		Individual Dwelling	3 or more Dwellings	General Use	Heavy-Use Assembly
Bar Sink.....	1-1/2"	1.0	1.0		
Bar Sink.....	1-1/2" ²			2.0	
Bathtub or Combination Bath/Shower.....	1-1/2"	3.0	3.0		
Bidet, 1-1/4" trap	1-1/4"	1.0	1.0		
Clinical Sink, 3" trap	3"			6.0	
Clothes Washer, domestic, 2" standpipe ⁵	2"	3.0	3.0	3.0	
Dental Unit, cuspidor.....	1-1/4"			1.0	
Dishwasher, domestic, with independent drain.....	1-1/2"	2.0	2.0	2.0	
Drinking Fountain or Watercooler.....	1-1/4"			0.5	
Food-waste-grinder, commercial.....	2"			3.0	
Floor Drain, emergency.....				0.0	
Kitchen Sink, domestic, with one 1-1/2" trap.....	1-1/2" ²	2.0	2.0	2.0	
Kitchen Sink, domestic, with food-waste-grinder.....	1-1/2" ²	2.0	2.0	2.0	
Kitchen Sink, domestic, with dishwasher	1-1/2" ²	3.0	3.0	3.0	
Kitchen Sink, domestic, w/grinder and dishwasher.....	1-1/2" ²	3.0	3.0	3.0	
Laundry Sink, one or two compartments.....	1-1/2"	2.0	2.0	2.0	
Laundry Sink, with discharge from clothes washer	1-1/2"	2.0	2.0	2.0	
Lavatory, single	1-1/4"	1.0	1.0	1.0	1.0
Lavatory in sets of two or three	1-1/2"	2.0	2.0	2.0	2.0
Mobile Home, trap	3"	12.0	12.0		
Mop Basin, 3" trap	3"			3.0	
Receptor, indirect waste, 1-1/2" trap ^{1,3}	1-1/2"			(1)	
Receptor, indirect waste, 2" trap ^{1,4}	2"			(1)	
Receptor, indirect waste, 3" trap ¹	3"			(1)	
Service Sink, 2" trap	2"			3.0	
Service Sink, 3" trap	3"			3.0	
Shower Stall, 2" trap.....	2"	2.0	2.0	2.0	
Showers, group, per head (continuous use)	2"			5.0	
Sink; commercial, 1-1/2" trap, with food waste	1-1/2" ²			3.0	
Sink, service, flushing rim.....	3"			6.0	
Sink, general, 1-1/2" trap.....	1-1/2"	2.0	2.0	2.0	
Sink, general, 2" trap.....	2"	3.0	3.0	3.0	
Sink, general, 3" trap.....	3"			5.0	
Urinal, 1.0 GPF.....				4.0	5.0
Urinal, greater than 1.0 GPF				5.0	6.0
Urinal, 1-1/2" trap	1-1/2" ²			4.0	5.0
Washfountain, 1-1/2" trap.....	1-1/2"			2.0	
Washfountain, 2" trap	2"			3.0	
Wash Sink, each set of faucets				2.0	
Water Closet, 1.6 GPF Gravity Tank ⁶	3"	3.0	3.0	4.0	6.0
Water Closet, 1.6 GPF Flushometer Tank ⁶	3"	3.5	3.5	5.0	8.0
Water Closet, 1.6 GPF Flushometer Valve ⁶	3"	3.0	3.0	4.0	6.0
Water Closet, 3.5 GPF Gravity Tank ⁶	3"	4.0	4.0	6.0	8.0
Water Closet, 3.5 GPF Flushometer Valve ⁶	3"	4.0	4.0	6.0	8.0
Whirlpool Bath or Combination Bath/Shower.....	2"	3.0	3.0		

¹Indirect waste receptors shall be sized based on the total drainage capacity of the fixtures that drain therein to, in accordance with Table 7-4.

²Provide a 2"(51 mm) minimum branch drain beyond the trap arm.

³For refrigerators, coffee urns, water stations, and similar low demands.

⁴For commercial sinks, dishwashers, and similar moderate or heavy demands.

⁵Buildings having a clothes washing area with clothes washers in a battery of three (3) or more, clothes washers shall be rated at six (6) fixture units each for purposes of sizing common horizontal and vertical drainage piping.

⁶Water closets shall be computed as six (6) fixture units when determining septic tank sizes based on Appendix K of this Code.

⁷Trap sizes shall not be increased to the point where the fixture discharge may be inadequate to maintain their self-scouring properties.

007. 07. Minimum Tank Capacities.

- a. Tanks serving one (1) or two (2) single dwelling units:

MINIMUM CAPACITY PER DWELLING UNIT

Number of Bedrooms	Minimum Liquid Capacity (gallons)
1 or 2	900
3 or 4	1000
For each bedroom over four	add 250 gallons

- b. Tanks serving all other flows. Septic tank capacity shall be equal to two (2) times the average daily flow as determined from Subsection 007.08. The minimum tank capacity shall be seven hundred and fifty (750) gallons.

08. Wastewater Flows From Various Sources in Gallons Per Day.

DWELLINGS	GPD
Single Family Dwelling and Mobile Homes, 3 bedroom. Add/Subtract 50 gallons per bedroom	250/unit
MULTIPLE RESIDENTIAL	
Hotel: With Private Baths Without Private Baths	60/Bedspace 40/Bedspace
Motel: With Kitchenette	40/Bedspace 60/Bedspace
Boarding House: Add for each nonresident	150/Bedspace 25
Rooming House/Bunk House: Staff Resident Nonresident	40/Resident 40/Staff 15/Staff
Apartments	250/Unit
INSTITUTIONAL	
Assembly Hall/Meeting House	2/Seat
Church: With Kitchen	3/Seat 7/Seat
Hospital: Kitchen only Laundry only	250/Bedspace 25/Bedspace 40/Bedspace
Nursing Home/Rest Home	125/Bedspace
Day School without Showers: With Showers With Cafeteria, add	20/Student 25/Student 3/Student
Staff-Resident Nonresident	40/Staff 20/Staff

6/11

FOOD SERVICE	
Conventional Service: Toilet and Kitchen Wastes Kitchen Wastes	13/Meal 3.3/Meal
Take Out or Single Service	2/Meal
Dining Hall: Toilet and Kitchen Wastes Kitchen Wastes	8/Meal 3.3/Meal
Drinking Establishment	2/Person
Food Service Employee	15/Employee
COMMERCIAL AND INDUSTRIAL	
Bowling Alley	125/Lane
Laundry-Self Service	50/Wash
Public Transportation Terminal	5/Fare
Service Station	10/Vehicle
Car Wash 1st Bay Additional Bays	50/Vehicle 1000 500 Each
Shopping Center (No Food/Laundry)	1/Parking sp.
Theaters (Including Concessions Stand): Auditorium Drive-in	5/Seat 10/Space
Offices	20/Employee
Factories: No Showers With Showers Add for Cafeteria	25/Employee 35/Employee 5/Employee
Stores	2/Employee
SEASONAL AND RECREATIONAL	
Fairground (Peak Daily Attendance)	1/Person
Stadium	2/Seat
Swimming Pool: Toilet and Shower Wastes	10/Person
Parks and Camps (Day Use): Toilet and Shower Wastes	15/Person
Roadside Rest Area: Toilet and Shower Wastes Toilet Waste	10/Person 5/Person
Overnight Accommodations: Central Toilet Central Toilet and Shower	25/Person 35/Person
Designated Camp Area: Toilet and Shower Wastes Toilet Wastes	90/Space 65/Space
Seasonal Camp	50/Space
Luxury Cabin	75/Person

Sanitary Sewer Lift Station Level Control Elevations

Lift Station Diameter = 4 ft
Base Area = 12.6 ft²
Cycle time = 4909.9 First pump on elevation
 4906.3 Both pumps off elevation
 3.6 ft
Volume at 3.6 ft from the base = 45 ft³ = 338 gal
Rate of Flow = 24 gpm
Cycle Time at 3.6 ft from the base = 14 min

Therefore the cycle time for the pumps at the rate of 24 gpm is every 14 minutes. The pumps will be setup to alternate.

Level Control	Elevation	Distance from the Base (ft)
Pumps Off (Emergency)	4906	0.5
Both Pumps Off	4906.3	0.8
First Pump On	4909.9	4.4
Both Pumps On	4910.4	4.9
High Level Alarm	4910.9	5.4

Bottom of Base Elevation 4905.5

8/11
— Data Point —

Flow: 20 US gpm

Head: 27.7 ft

Eff: - %

Power: - bhp

NPSHr: - ft

— Design Curve —

Shutoff Head: 36.4 ft

Shutoff dP: 15.8 psid

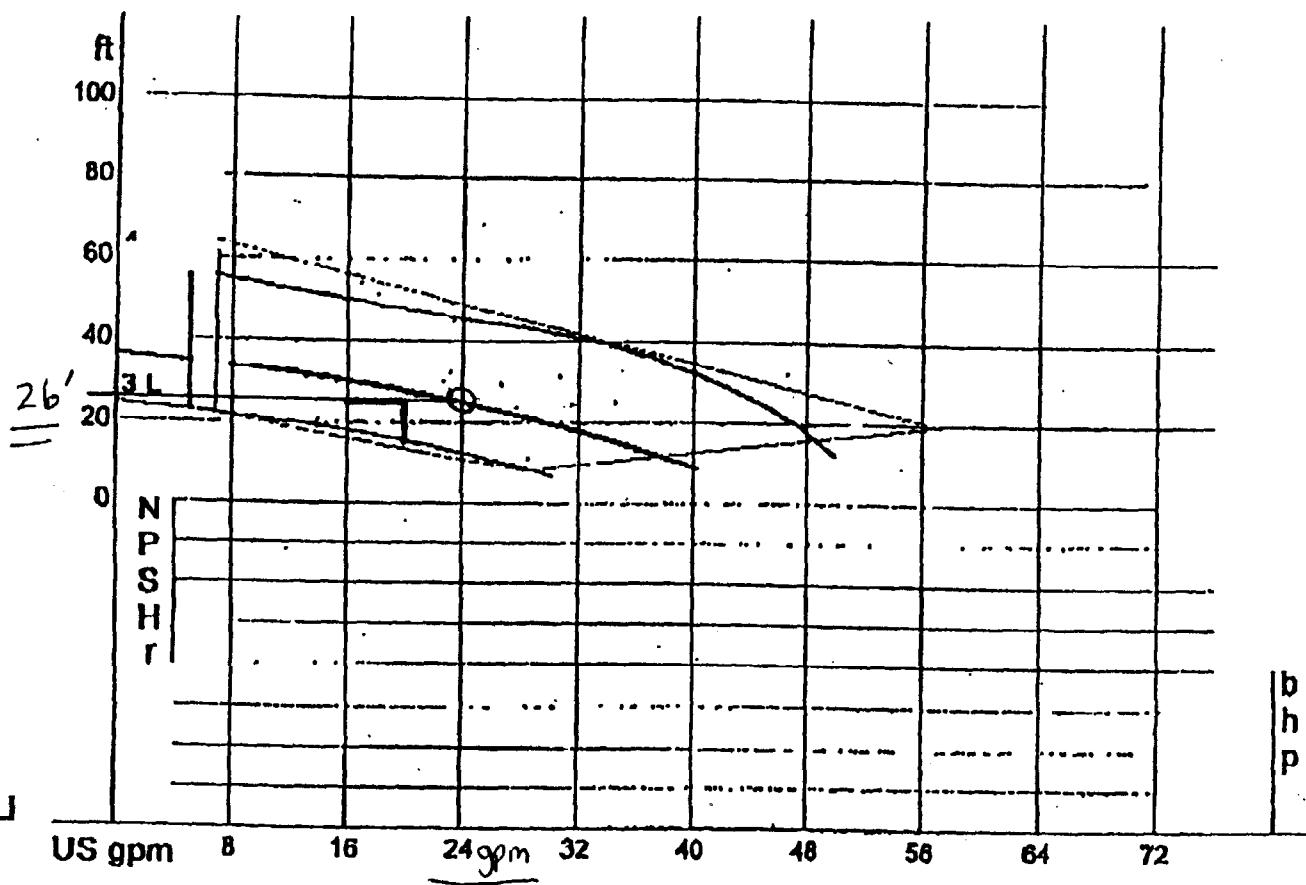
Min Flow: 5 US gpm

BEP: - % off

NOL Pwr. - bhp

— Max Curve —

Max Pwr. - bhp



— PERFORMANCE EVALUATION —

Flow US gpm	Speed rpm	Head ft	Pump %eff	Power bhp	NPSHr ft	Motor %eff	Motor kW	Hrs/yr	Cost MWh
24	3450	25	—	—	—	—	—	—	—
20	3450	27.7	—	—	—	—	—	—	—
16	3450	30.4	—	—	—	—	—	—	—
12	3450	32.2	—	—	—	—	—	—	—
8	3450	34.1	—	—	—	—	—	—	—

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CHECK PUMP FOR SANITARY SEWER

$$Q = 24 \text{ GPM OR } 0.054 \text{ CFS}$$

$$A \text{ 2" HDPE} = \pi r^2 = (2)^2 \pi = 3.14 \text{ IN}^2 \text{ OR } 0.022 \text{ FT}^2$$

$$V = Q/A = \frac{0.054}{0.022 \text{ FT}^2} = \underline{\underline{2.43 \text{ FT/SEC}}}$$

LENGTH OF PIPE 387

426

923

1736 L.F. \approx 1700 L.F.

HEAD CALCS FOR PUMP.

STATIC 4910.0 - M.H.

4906.2 - LIFT STATION

3.8 FT SAY 4 FT.

Friction Loss

$$h_L = f \frac{V^2}{2g} \frac{L}{d} = 0.022 \frac{(2.43)^2}{64.4} \frac{(1700)}{0.167} = \underline{\underline{21 \text{ FT}}}$$

$$\text{VEL HEAD} = \frac{(2.43)^2}{64.4} = 0.09 \text{ FT.}$$

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5.01.01

10/11

2

MINOR LOSSES

Minor Loss	No.	K-Value	Total K-Value
90° ELBOW	3	0.35	1.05
LONG ELBOW	2	0.14	0.32
GATE VALUE	1	0.20	0.20
CHECK VALUE	1	2.00	2.00
EXIT LOSS	1	0.50	0.50

TOTAL 4.07

$$\text{Loss} = K_f \frac{V^2}{2g} = 4.07 \times 0.09 = 0.4 \text{ ft.}$$

$$\begin{aligned} \text{TOTAL LOSSES} &= 4 \text{ FT} - \text{STATIC} \\ &\underline{21 \text{ FT}} = \text{FRICITION} \\ &\underline{1 \text{ FT}} = \text{MINOR LOSSES} \\ &26 \text{ FT} \quad \text{OR } 11 \text{ PSI} \end{aligned}$$

HORSEPOWER OF PUMP

$$WHP = \frac{Q h_s \rho g}{3960}$$

$$HP = \frac{24 \times 26}{3960} = 0.2$$

ASSUME 30% EFF PUMP
60% EFF MOTOR.

$$\text{TOTAL} = \frac{0.2}{0.3 \times 0.6} = 1.1 \text{ HP} \quad \underline{\text{USE 2 HP PUMP}}$$

Two